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ABSTRACT

For this study of the influence of the diameter of implements on children's drawing products, performances, and preferences, toddlers and preschoolers were observed while they drew with primary (larger-sized) and standard markers, pencils, and crayons. The relationship between drawing and early home manipulative experience was also investigated. A total of 20 children were observed while they completed spontaneous drawings, geometric form copying, and tasks involving the drawing of a girl or a boy. The tasks were taken from the Riley Preschool Developmental Screening Inventory (1969). Findings revealed that levels of symbolic representation in free drawings, geometric forms, drawings of boys or girls, and handgrips, were similar for primary and standard instruments. More children claimed to like the standard instrument than to dislike it. Early home manipulative experience, including buttoning, cutting with scissors, coloring and drawing, and building with Duplo or Lego materials, was related to children's more mature drawing products and performances. It is concluded that results confirm findings of previous studies that indicate that even very young children are able users of standard drawing instruments. (Author/RH)

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A Descriptive Study of Toddlers and Preschoolers Drawing with Primary and Standard Markers, Pencils and Crayons

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Abstract

Toddlers and preschoolers drawing with primary and standard markers, pencils, and crayons were studied to determine the influence of implement diameter on children's drawing products, performances, and preferences. The relationship of drawing and early home manipulative experience was investigated as well. Twenty children were observed completing spontaneous drawings and geometric form copying and draw-a-girl (boy) tasks on the Riley Preschool Developmental Screening Inventory (Riley, 1969). Levels of symbolic representation in free drawings, geometric forms and boy (girl) drawings, and grips produced with primary and standard instruments were highly similar. While children more frequently selected a primary instrument first for drawing, more stated they liked the standard instrument. Early home manipulative experience, including buttoning, cutting with scissors, coloring/drawing, Duplo/Lego building, pasting, doll dressing, and shoe lacing were related to children's more mature drawing products and performances. Results confirm and extend findings of previous studies indicating that even very young children are able users of standard drawing instruments.

In early childhood classrooms it is customary to provide small hands with large primary drawing and writing tools (e.g., Lowenfeld, 1954; Smith, 1977). It has been assumed that young children require larger than ordinary instruments because of immature eye-hand coordination and fine-motor control skills. Yet there is compelling evidence that children early develop sufficient fine-motor control to adequately use any number of materials, including tools for writing and drawing (e.g., Williams, 1983). Moreover, most young children can successfully use standard adult-size instruments in their drawing and writing (Carlson & Cunningham, 1990; Lamme & Ayris, 1983; Parker, 1972; Salome, 1967; Sims & Weisberg, 1983; Smith, 1977; Wiles, 1943).

To determine whether or not the primary drawing/writing instrument affords the child any particular advantage, researchers have focused primarily on the products of children's drawing and writing activity, studying the marks made with tools of varying diameters. Of secondary focus have been efforts to document effects of instrument diameter on children's successful instrument manipulation.

In evaluations of the pre-handwriting and handwriting products of first graders (Lamme & Ayris, 1983; Wiles, 1943), kindergartners (Smith, 1977; Weisburg & Sims, 1983), and older preschoolers (Carlson & Cunningham, 199) written with standard and primary pencils, researchers have concluded the primary tool does not

contribute measurably to children's handwriting legibility. Moreover, in studies of the drawing of kindergartners produced with primary crayons and standard colored pencils (Salome, 1967) and older preschoolers completed with pencils (Parker, 1972), investigators found only that children drew larger pictorial elements when using larger instruments. Again, the primary tool was not found to contribute substantially to children's drawing success.

Thus, while there is overwhelming evidence that the drawing and writing products of young children, particularly older preschoolers, kindergartners and first-graders, are not enhanced when they use larger than ordinary tools, several questions remain. First, might there be some advantage for the still younger child, the young preschooler or toddler, who uses a larger drawing instrument? In that Parker (1972) and Carlson and Cunningham (1990) included older preschoolers, replication with a younger preschool population is in order. Moreover, in that toddlers are now enrolled in pre-K settings in growing numbers, it is important to have information about the abilities of toddlers as well.

Second, recognition that the early spontaneous drawing and pre-writing attempts of the young child are critical to writing and handwriting development (e.g., Dyson, 1990; Klein, 1985) makes the influence of tool size on young children's drawing an

area worthy of additional investigation. Third, children's more frequent use of crayons and markers than pencils for drawing and other pre-writing activity in preschool and day care settings makes study of children's use of these instruments desirable.

In several studies investigators have asked to what extent children's management of the drawing/writing tool itself is influenced by instrument diameter. Gesell (1940) and Rosenbloom and Horton (1971) detailed the developmental course of young children's manipulation of writing/drawing tools from the hammer-like jabs of the infant to the deft adult-like, finger-controlled motions of the kindergartner and first-grader.

Intuitively, one might expect the larger tool, as touted by manufacturers (e.g., Dixon, 1970, cited in Parker, 1972) and pedagogues (e.g., Waldrop & Scarborough, 1990), to afford decided manipulative advantage to its young user. Again the available research evidence suggests that children five and older manipulate primary and standard tools with equal facility. Young children use larger pencils with as much or as little tension, frustration, or correct hand position as they do the small (Carlson & Cunningham, 1990; Salome, 1967; Wiles, 1943). Missing pieces of the research puzzle include identification of effects of diameter on coordinated usage of two- and three-year-olds and comparison of children's performances with primary and standard markers and crayons.

A related issue in consideration of the appropriate diameter of writing/drawing tools for young children is determination of what children like using. Children's preferences for particular drawing/writing tools have been gauged either by observing children's self-selection of tools when given a choice or by asking children which size tool they like best. Among studies of child reports of preference, Herrick (1943) first stated that elementary-age children liked using adult-size writing tools better than primary-size. Lamme and Ayris (1983) concluded children "rank the primary-size pencil at the bottom of their lists of preferred tools" (p. 37). Carlson and Cunningham (1990) also tapped children's preferences by asking and found children by and large preferred the smaller pencil.

On the other hand, Parker (1972) assessed children's preference on the basis of children's self-selection of tools. Parker reported kindergartners, when selecting from among the three pencils available in their writing packet, significantly more frequently used the primary pencil than the standard or stenographic pencil. However, boys were more frequently observed using the large pencil and girls the small. Finally, Salome (1967) found that the majority of kindergartners selected the smaller colored pencils, given a choice between small colored pencils and large primary crayons for using in two art activities some two months after the initial study.

From these assessments it is not clear whether there is correspondence between what children use and what they say they like. Given conflicting findings, further investigation of young children's preferences for instruments of particular diameter appear warranted. The extent to which children's choices are determined by habit or effects of novelty (e.g., Harris, 1965) or modeling are not known.

Finally, with the period of toddlerhood through middle childhood recognized as critical for fine-motor skill refinement (Williams, 1983), it seems important to be able to specify which, if any, early manipulative experiences may positively contribute to young children's drawing and later writing skill. It is generally agreed that the successful use of pencil, marker, or crayon as a tool for drawing or writing requires a certain level of fine-motor control and that the key to such coordinated usage is experience (e.g., Sims & Weisburg, 1983; Williams, 1983). Yet, no one has studied the relationship between children's early fine-motor manipulative experience and drawing performance.

The purpose of the present investigation was to compare the drawing products and performance of very young children as they employed standard and primary instruments, to tap young children's preferences for standard and primary drawing tools, and to explore the relation of early manipulative experience to their drawing products, performances, and preferences. In this study toddlers

and preschoolers were observed as they performed several structured and unstructured drawing tasks using primary and standard crayons, pencils, and markers. In addition, children's parents reported their children's use of a variety of fine-motor manipulatives at home.

In order to replicate and extend what is known and reviewed above about young children's drawing tool usage, the following research questions were posed:

1. Do the products of toddlers' and preschoolers' structured and spontaneous drawing completed with standard and primary markers, pencils, and crayons differ on the basis of the diameter of the instrument used?

2. Do children's performances (e.g., grip maturity) with standard and primary markers, pencils, and crayons vary on the basis of the diameter of the instrument used?

3. Do young children prefer using standard or primary markers, pencils, and crayons?

4. In what ways do children's early experience with fine-motor manipulatives at home correlate with their drawing products, performances, and preferences?

Method

Subjects

Twenty children (10 boys and 10 girls) participated in the study--6 two-year-olds (range = 24-31 months, $\bar{X}$ age = 27.2 months),

8 three-year-olds (range = 37-47 months, $\bar{X}$ age = 41.7 months), and 6 four-year-olds (range = 49-59 months, $\bar{X}$ age = 55.8 months). All children were from intact, middle-class families. Nineteen children were white, one Hispanic. Three- and four-year old preschoolers attended a one-morning-a-week preschool session at a major southeastern university; two-year-old toddlers were enrolled in a similar toddler program at the same university. Two toddlers were not included in the sample. One toddler refused to participate; another was unable to participate because of family scheduling problems.

Materials

The Riley Preschool Developmental Screening Inventory (Riley, 1969) was used as a measure of children's ability to copy geometric forms and to draw a person. Three sets of drawing tools, each including a standard and a primary instrument, were used by the children: Binney and Smith Classic Color Markers (8-marker sets), 9/16" and 3/8" diameter; Empire Husky pencil, 9/32" diameter and #2 pencil, 13/32" diameter; Binney and Smith crayons (8-crayon sets), 5/8" and 7/16" diameter. Sheets of 8" x 12" manila paper were used for children's spontaneous drawings.

Procedures

All children participated in a series of three tasks--drawing with markers, pencils, and crayons. The order of drawing tasks was the same for toddlers and preschoolers--free drawing and Riley

Inventory with markers, free drawing with pencils, and free drawing with crayons.

To minimize distractions toddlers were tested individually during a single session in their own homes. Toddlers were tested at a table identified by their parents as a place where they ordinarily engaged in similar activity and would be comfortable.

Preschoolers performed their drawing tasks in their preschool classroom. For preschoolers marker, pencil, and crayon drawing tasks were presented as sequentially scheduled, self-selected art activities during their regular indoor freeplay period on three different days over a four-week period. Therefore several preschoolers could draw together at a large table at the same time.

All sessions were conducted including testing, videotaping, observation, and compilation of running handwritten records by the author and teams of trained undergraduate research assistants. Research assistants were college students serving as assistant teachers in the preschool.

Free Drawing Episodes

An activity table was arranged with paper and two baskets, one containing a set of primary and the other containing a set of standard drawing tools (markers, pencils, or crayons), available to each child. As children approached the table, each child was greeted by an experimenter and invited to "draw a picture."

Children were asked "Which marker (pencil or crayon) would you like to use first?" and encouraged to draw whatever they liked. Experimenter comments were limited to statements like, "That's very nice." Children were permitted to draw for as long as they liked or to use as many pieces of paper as they needed. When children were finished, they were asked, "Can you tell me about your picture(s)?" All child drawings were collected and labeled for later scoring.

Riley Preschool Developmental Screening Inventory

The Riley Inventory (Riley, 1969) was presented to the child as a drawing game, after the child had finished his or her free drawing with markers. With order of performance determined by the flip of the coin, the child completed two inventories, copying geometric forms and drawing a girl or boy, with a standard marker and with a primary marker.

Experimenter comments were made according to the Riley testing protocol. First tracing each shape with a finger the experimenter said, "Look here." Then tracing an identical shape in the space beside, the child was told to "Draw one just like it right here." The child was permitted three chances, if necessary. Last, the child was told to "Make a boy (girl)" as the experimenter pointed to the final blank page of the testing booklet.

Testing modifications of the Riley were necessary for toddlers. Vertical and horizontal line copying were added as

tasks appropriate for toddlers in the geometric form copying section. Scribbling without discernible features was added as appropriate two-year-old response in the draw-a-girl (boy) portion. Gesell and Ilg's (1949) developmental guidelines were used as a basis for this revision and scoring.

Parent Questionnaire. Assessments of early home manipulative experience were distributed with permission letters for child participation prior to testing. Parents received a questionnaire with a list of 10 common, fine-motor manpulative activities. Activities included: cutting with scissors, doing puzzles, block building, coloring/drawing, painting, pasting, shoe lacing, doll dressing, buttoning, and Lego/Duplo building. Parents rated each activity for frequency of child use at home, degree of child interest, and level of ease or difficulty of child use.

Measures

Product. Children's free or spontaneous drawings were assessed for level of symbolic representation: scribble (1), shapes (2), letters (3), objects (4). If drawings contained several categories, a composite score was tallied. To be scored, each item had to be discernable to the adult eye without the child saying what the product was.

Riley Inventory drawings received two scores, a developmental age for geometric form copying and a developmental age for drawing a girl/boy. Geometric form scores were based on established

developmental norms for shapes expected to be satisfactorily completed at each age. Draw-a-girl (boy) scores were based on established developmental norms for number of recognizable features expected to be drawn at each age (Gesell & Ilg, 1949; Riley, 1969).

Performance. Children's tool grip was used as the measure of performance or tool manipulative ability. During each task children's grips were categorized as palmar (1), digital pronate (2), tripod (3), or dynamic tripod (4) (Alston & Taylor, 1987; Harries & Yost, 1981). If a child shifted grips during a task, the most advanced grip employed was coded.

Preference. Children's preferences for standard or primary tools were assessed during each free drawing task by observing which size instrument the child picked up and drew with first--"skinny" (1), "fat" (2). In addition, after completing marker drawings and crayon drawings, children were asked, "Which marker (crayon) did you like best, fat or skinny?" and child verbal responses or gestures were recorded--"skinny" (1), "fat" (2), both (3).

Experience. Frequency ratings of child home use of each of the 10 fine-motor manipulatives comprised the child fine-motor manipulative experience score. Parent ratings indicated child use on a daily (3), weekly (2), monthly (1), or never (0) basis.

Scoring. Practicum students initially scored child products, grips, preferences, and home manipulative experience. Using

scoring protocols trained student teams acted as a panel of judges, and scores were assigned when consensus was reached. Subsequently all tapes, handwitten records, and student scores were judged by the senior author and an advanced undergraduate student naive to the purposes of the study. Scores were confirmed again by consensus according to protocol.

Results

Children's Drawing Products

The first objective of the study was to examine the influence of diameter of drawing tool on children's drawings. Pearson product-moment correlations were performed to detect similarities and differences between the levels of representation in children's free drawings completed with each standard and primary instrument: marker, pencil, and crayon. Product-moment correlations were also computed between developmental ages yielded on Riley geometric form copying and draw-a-boy (girl) products when the children used standard versus primary markers. While all children had access to both primary and standard drawing tools, in some instances children selected and used a single size tool during the entire free drawing episode.

Free drawing with markers. When the children drew with standard markers there was a tendency, although statistically insignificant, to make marks at higher levels of symbolic

representation ($r = -.25$, $p < .25$; standard marker $\bar{X} = 2.2$, primary marker $\bar{X} = 1.4$, $n = 9$).

Free drawing with pencils. The levels of symbolic representation of children's drawings made with standard and primary pencils were highly similar ($r = .81$, $p < .001$; standard pencil $\bar{X} = 2.2$, primary pencil $\bar{X} = 2.1$, $n = 14$).

Free drawing with crayons. Children's crayon drawings reflected a markedly similar level of symbolic representation ($r = .81$, $p < .001$; standard crayon $\bar{X} = 2.5$, primary crayon $\bar{X} = 3.1$, $n = 13$).

Riley inventory. Geometric form-copying scores ($r = .96$, $p < .001$; $n = 18$) and draw-a-boy (girl) scores ($r = .77$, $p < .001$, $n = 16$) reflected highly similar child products with standard and primary markers.

Children's Performances

The second objective of the study was to detect differences/similarities in grips used with the primary and standard version of each drawing tool using Pearson product-moment correlations. First, children's average grips using small tools and average large grips were found to be highly positively related ($r = .96$, $p < .001$, $n = 20$). Furthermore, there were high positive correlations between the grips children used with standard and primary instruments in each task (Table 1).

(insert Table 1 here)

Children's Preferences

The third objective of the study was to determine the preferences children have for standard or primary drawing tools. Frequencies of order of instrument selection and preference statements are shown in Table 2. Children were more likely to select a primary instrument when they first began drawing but, when querried, stated they liked the standard instrument better. There were no significant correlations between order of marker use and statement of marker size preference ($r = .33$, $p < .15$, $n = 12$) or between order of crayon use and statement of crayon size preference ($r = .34$, $p < .11$, $n = 15$).

(insert Table 2 here)

Children's Home Experience with Fine-motor Manipulatives

The final objective of this study was to see if children's home manipulative task performance was related to their drawing products, performances, and preferences. Because of high, positive intercorrelations of frequency and ease ($r = .47$, $p < .018$, $n = 20$), and frequency and interest ($r = .56$, $p < .006$, $n = 20$), only frequency of use scores were used.

The relation of child manipulative use at home to children's free drawing products. Correlations between total frequency of home manipulative use and free drawing products with each of the six different drawing tools were performed. Positive relationships

were found in two of these six comparisons, between total frequency of manipulative use and primary pencil products ($r = .55$, $p < .008$, $n = 18$) and between total frequency of manipulative use and primary crayon products ($r = .44$, $p < .037$, $n = 17$).

Additional correlations between use of each manipulative and the free drawing products of each drawing tool were made. Cutting with scissors, pasting, buttoning, and Lego/Duplo building were found to be positively and significantly related to various products (see Table 3).

[insert Table 3 here]

The relation of child manipulative use at home to children's Riley Inventory products. Correlations between total frequency of home manipulative use and Riley geometric form copying scores and draw-a-girl (boy) scores were performed. Positive relationships were found between manipulative use and geometric form copying scores with the standard marker ($r = .58$, $p < .004$, $n = 19$) and with the primary marker ($r = .50$, $p < .01$, $n = 19$) and draw-a-girl (boy) scores with the primary marker ($r = .39$, $p < .05$, $n = 18$). Examining correlations between frequency of use of each manipulative and structured drawing performance--geometric form copying, draw-a-girl (boy) scores--frequency of cutting with scissors, coloring and drawing, pasting, doll dressing, and buttoning were found to correlate positively with performance (see Table 3).

The relation of child manipulative use at home to children's performance/grip maturity. Frequency of home manipulative use was positively related to grip maturity--to children's average small instrument grip ($r = .52$, $p < .009$, $n = 20$) and to children's average large instrument grip ($r = .53$, $p < .008$, $n = 20$).

The relation of child manipulative use at home to children's preferences for size of drawing tool. No significant relationships were found between total manipulative use scores or individual manipulative use and children's preferences, as expressed by instrument selection or verbal statement/gesture.

Discussion and Conclusions

The results of the present study both confirm and extend previous findings about the influence of instrument diameter on children's writing and drawing products, preferences, and performances. First, it was found that the marks children made during free and structured drawing tasks were unaffected by instrument diameter. Diameter of magic marker was not found to influence geometric form copying or draw-a-boy (girl) performances in structured drawing tasks or level of symbolic representation in spontaneous drawings. Neither was diameter of pencil or crayon found to influence children's level of symbolic representation in free drawings using those instruments.

It is apparent that if a child can copy a square with a primary marker he can just as successfully copy a square using

a standard marker. Alternatively, if a child can only scribble with a small pencil, he will scribble as well with a large pencil. These findings are consistent with preceding studies of the effects of instrument diameter on children's drawing and writing (Carlson & Cunningham, 1990; Lamme & Ayris, 1983; Parker, 1972; Smith, 1977; Weisberg & Sims, 1983; Wiles, 1943).

Further, it appears that the fine-motor control of the very young child--two and older--is sufficiently developed for performing adequately with a standard instrument. This view of the more competent toddler and preschooler is consistent with current views of young children's physical competencies including eye-hand coordination and fine-motor control (e.g., Williams, 1983).

One might expect that if the primary tool afforded a child a special advantage, that the child would demonstrate a more capable (mature) grip while using the larger drawing or writing tool as compared to the grip on a smaller tool. Such was not the case, however. Remarkably high positive correlations between the grip children employed on both small and large instruments were found. Again, if a child could employ a dynamic tripod grip on the larger pencil he could just as easily employ the same grip on the standard pencil. If on the other hand, the child used a hammer grip on the small crayon, he employed the hammer on the large.

As to what children prefer using, in this study children were found to spontaneously select and use the larger drawing tool first more frequently than the small, consistent with Parker (1972). Yet, when querried, children more often said they liked using the "skinny" instrument better, consonant with the Lamme and Ayris (1983) study. These seemingly incongruous findings may be linked to habit, novelty effects, and effects of modeling operating simultaneously.

In this study children may have selected the primary-size instrument first because it was the sized tool they were accustomed to using or because it was novel or unfamiliar. And despite first use, it is not surprising that most young children said they liked the smaller adult-sized instrument, reflecting modeling effects, preferring the tool they have most likely seen parents, teachers, and older siblings using. In future studies of children's preferences, investigators will want to control for habit, novelty, and modeling effects by first determining which sized instruments the child is accustomed to using and seeing being used.

In addition, attention should be directed to identifying the purposes children have for using various types and sizes of instruments (i.e., drawing detail, filling in large spaces, emboldening outlines). Just as artists employ a variety of tools to accomplish a variety of visual effects, it is reasonable to expect children to begin to do so in their work as well.

Finally, it is apparent that certain early home manipulative experiences are related to and may contribute to children's spontaneous and structured drawing performances. It was found that children who used the listed manipulatives more frequently at home tended to draw at higher levels of symbolic representation in spontaneous drawings with the primary pencil and the primary crayon. Furthermore, more frequent cutting with scissors, buttoning, and playing with Legos were related to higher levels of symbolic representation in spontaneous drawings made with several different drawing tools.

In structured drawing performances, frequent users of home manipulatives copied geometric forms more accurately when using standard and primary markers and drew girls (boys) with more detail when using primary markers. Additionally, cutting with scissors, coloring and drawing, pasting, doll dressing, and buttoning were found to be specific activities related to geometric form copying and draw-a-girl (boy) competencies.

In line with expectations, children who engaged more frequently in a variety of fine-motor manipulative activities at home, as reported by their parents, were found to have more sophisticated grips when using both large and small drawing tools. Alternatively children with limited manipulative experience held drawing tools with less mature grips.

Further study of these interesting linkages pointing to possible contributions of early manipulative use to later drawing and writing competency is recommended. In that some individual manipulative opportunities were provided more frequently to girls than boys (scissor cutting, doll dressing, and buttoning) and others to older preschoolers than younger (pasting, shoe lacing, buttoning), a study of how young children's opportunities for manipulation of tools, toys, and other household objects may vary by gender and over time, and the relationship of opportunity to drawing performance is suggested.

Summary

The present study was an investigation of the influence of drawing instrument diameter on children's drawing. By including toddlers and young preschoolers, as well as making within-tool-group comparisons (e.g., primary versus standard markers, pencils, and crayons), an expanded view of the very young child as capable technically and conceptually of using standard-size drawing instruments is afforded. The larger primary-size instrument, as a special tool ostensibly for younger children, does not contribute measurably to either children's drawing products or performances.

That even very young children said they preferred the smaller tool and used both the primary and standard instruments in their drawing when presented the opportunity to do so, points to a need

to modify practice in many early childhood classrooms. It is suggested that developmentally appropriate practice include acknowledgment of children's competencies, preferences, and purposes for drawing/writing tool use and provision of instruments of varying types and diameters for young children for their drawing and writing.

Finally, it appears certain technical and conceptual proficiency dividends may accrue for the child who engages early in a variety of early fine-motor experiences. Further investigation of the contribution of specific manipulative activities to children's drawing and writing competencies is encouraged.

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Table 1

Grip Correlations

	r	p	n
Free Drawing with Markers	.77	.008	9
Riley	.89	.001	18
Free Drawing with Pencils	.74	.001	14
Free Drawing with Crayons	1.00	.001	13

Table 2

Frequencies of Order of Drawing Tool Use and Preference Statements

	Preferences				
	Order of Use			Preference Statement	
	Marker	Pencil	Crayon	Marker	Crayon
Standard	7	6	6	9	7
Primary	12	11	13	3	3
Both	--	--	--	-	5
Missing	1	3	1	8	5

Table 3

Correlations of Home Manipulative Use and Drawing Product Scores

Drawing Products	Riley				Free Drawing Level of Representation					
	Geometric Form Copying		Draw-a-Girl		Marker		Pencil		Crayon	
Frequency Manipulative Use	S	P	S	P	S	P	S	P	S	P
Scissors	.55**	.51**		.40*	.46*		.47*	.57**		
Puzzles										
Blocks										
Coloring/ Drawing				.43*						
Painting										
Pasting	.49**	.63**			.43*					.47*
Shoe lacing										
Doll Dressing				.48*						
Buttoning	.48**	.45*						.48*		.54**
Legos/Duplos							.47*	.45*		
Total	.58**	.50**		.39*				.55**		.44*

*p .05

**p .01